



DEVELOPMENT OF A FINGER-INK BASED ON CORN STARCH COLORED WITH GRAPE POMACE PIGMENTS

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Resumo

The valorization of agro-industrial residues has recently gained significant interest due to their underutilization. Among these residues is grape pomace. At the intersection of sustainability, food technology, and education, new pedagogical materials have been proposed, such as finger inks for children which, in this context, have become a promising application for grape pomace. This study aimed to develop a corn starch-based inks colored with pigments extracted from grape pomace (donated by Terras Altas Winery, Ribeirão Preto – SP). Two fractional factorial designs (2^{4-1}) were conducted: (i) to study the effects of starch concentration (5–15%), gelatinization temperature and time (70–90 °C and 10–20 min), and glycerol percentage (2.5–7.5%) on the ink formulation; and (ii) to assess the effects of extraction temperature (45–75 °C), extraction time (15–45 min), pH (2–12), and pomace mass (5–10%) on pigment extraction. The dependent variables for the base formulation were ink firmness (N), cohesion energy (mJ), adhesiveness (N·s), and viscosity (Pa·s); and for pigment extraction: color parameters (a, b, L*), total anthocyanin content (C3GE – mg/L), and pH. The results showed that ink firmness, cohesion energy, and adhesiveness ranged from 0 to 4.605 ± 0.456 N, 0 to 43.652 ± 9.596 mJ, and 0 to 0.484 ± 0.252 N·s, respectively, while viscosity reached a maximum of 203.23 Pa·s. Temperature and starch concentration were the two most significant factors ($p < 0.05$) affecting the ink formulation. Pigment extraction resulted in three distinct color groups based on pH: acidic pH (=2) produced reddish hues; slightly acidic pH (=4) yielded purplish tones; and basic pH (=9) resulted in darker, blackish tones. The total anthocyanin content, the major pigment responsible for the coloration, ranged from 0 to 41.83 ± 0.59 mg/L (C3GE). In search of a formulation that maximized color intensity, firmness, cohesion, and adhesiveness, the optimal formulation was defined using the desirability function. Based on the desirability function, the optimal formulation for the ink was defined as 10% starch, gelatinized at 80 °C for 15 minutes, with 5% glycerol. Also, the pigment with the highest anthocyanin concentration was selected, extracted at 75 °C for 15 minutes, at pH 2, and with 10% grape pomace mass. This resulted in a corn starch-based ink with an initial pinkish color and visually appealing characteristics. In addition, future studies should include target audience acceptance tests and allergenicity assessments to ensure the product's safety and applicability in educational settings.



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Instituições

¹ Universidade de São Paulo

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Eixo Temático

- Formulação e Processamento de Alimentos (FP)

Palavras-chave

Grape pomace

Finger-Ink

Sustainability

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